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BRUSH DIVISION OF THE PITTSBURGH PLATE GLASS COMPANY LOCATED IN BALTIMORE

All About Brushes

A History of Brushmaking with Descriptions of the Materials Used and the Methods of Gathering Them; Modern Manufacturing Methods and a Note on Brush Merchandising

PITTS BURGH PLATE GLASS COMPANY

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A Brief History of Brushmaking

The life story of brushes dips deeply into history. The cease-less desire of man to become immortal has expressed itself throughout all ages in drawings or paintings which record his life, his adventures and his thoughts. He has found a means of living in ages far beyond his normal life in so simple an instrument—as a brush.

But, oddly, while brushes have recorded the epic of mankind, their own story must be reconstructed from a few chance remarks of archaeologists or early craftsmen and the occasional mute evidence of the primitive tools themselves.

Cavemen left records of their hunts, and surprisingly ac-

curate pictures of animals, drawn with charcoal and bits of colored earth; but it was the ancient Egyptians, in their characteristic civilization, who first extensively used liquid paints . . . and brushes.

The French archaeologist Maspero wrote that the Egyptians, scorning pencil and stylus, "used reeds, the ends of which, soaked in water and split into fine fibres, formed a brush, large or small according to the size of the stem." In the British Museum there may still be seen three such brushes, evidently made from reeds or stems of palm leaf. With them are palettes, a color box and the remains of colors.

With Greece supplanting Egypt as the center of civilization we find Athens offering a welcome to the greatest artists of the times and the beginnings of classic antique art. During the early period Greek artists employed the tails and feet of small furbearing animals as brushes. The theatre was one of the great art forms of the time and to it we can readily trace the theatrical profession's custom of using a hare's foot for applying grease paint make-up.

With the improvement in painting technique Greek artists turned gradually from conventionalized or schematic painting to more realistic art under Apollodorus, about 400 B.C. Pliny, the Elder, the celebrated Roman naturalist who perished in the eruption of Vesuvius when Pompeii was destroyed in 79 A.D., said of Apollodorus that "he first bestowed true glory on the brush"; and of Zeuxis, a contemporary of Apollodorus, "Zeuxis gave the painter's brush the full glory to which it before aspired."

The decline of the civilization of Greece and Rome brought on the Dark Ages, and until the dawn of the Renaissance, art, with its demand for brushes, lay dormant. Then, with the study of the literature of Greece brought to Italy by the Byzantine scholars, began the transition from the medieval to the modern world and the revival of classic art.

In 1437 Cennino Cennini completed his great *Treatise on Painting* which gives us detailed descriptions of the making of bristle and "miniver" artist brushes—for in those days the artist

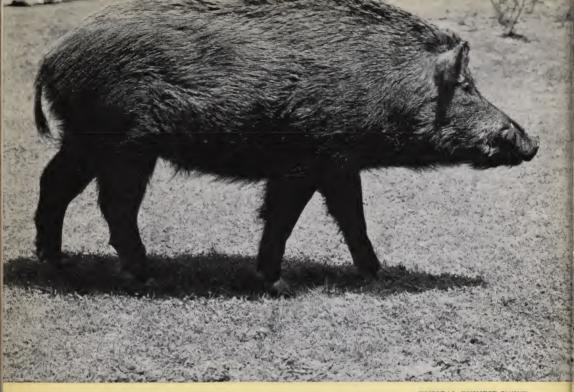
had to be a brush artisan as well—and the first reference that has come to light regarding paint brushes, as contrasted with artist brushes.

From the early Thirteenth Century it was the custom to whitewash the interior of castles and then to apply colorful decoration over this surface. From Cennini's description: "make a large brush in which you put a pound of bristles, and bind them to a large stick . . . you may use this for whitening walls," it is evident that the "pound brush", used even until this day, was an established type by the Fifteenth Century.

Eventually brushmaking became a recognized industry; brushmakers' guilds were formed in England and France and special privileges were granted to them.

Until relatively recent times brushes for painting were all round, or approximately so. About 1840 we find the first record of flat brushes, made of the "stucco" type, being tried in England. However, it remained for the American brush industry to develop modern stucco brushes, as well as metal bound flat paint and varnish brushes, to their present high level of practical design and efficiency.





TYPICAL CHINESE SWINE

BRISTLE • The Starting Point

Painting is among the oldest of the crafts practiced by man, and yet it took thousands of years to discover that bristle is the ideal material for applying paint; in fact, it was not until the year 1437 A. D. that we find the first written record of it being used in brushes.

Bristle, which is the name given the hair of the pig, is the most important material used in the manufacture of brushes for two reasons: its split end or "flag", and its taper. These unique characteristics of bristle are not found in the hair of any other animal than swine.

The flag gives bristle its capacity or ability to carry paint,

holding it by capillary action just as a pen, for example, carries ink. The sketch below, showing the flag magnified, also shows how the bristle tapers from the flesh end, or butt, to a noticeably smaller diameter at the flag.

You have doubtless noticed that flag poles are tapered—to make them stiff and rigid: the same principle is exemplified in bristle. The natural taper gives bristle its stiffness or elasticity, and its ability to work paint into the surface, so that the paint secures a better footing and wears longer.

Up to the time of this writing no substitute for bristle has been found in nature suitable for use in paint brushes. However, science may eventually offer a material which will approximate the performance of natural bristle in paint application. Synthetic bristle is being used on a commercial scale in the manufacture of tooth brushes and it is not impossible that the characteristics of natural bristle may be reproduced in synthetic bristle for use in paint brushes as well.

The four corners of the earth are scoured for materials that go to make a brush; Europe, Asia, North and South America, all are represented in brushes of many types, but China, that great land of mystery and lethargy, contributes the bulk of the most important item in brush manufacture—bristle!

China sprawls over Asia to the extent of four million square miles, with climate ranging from the Sub-tropical to that of the Arctic. In every province, however, swine are found, as pork is

> THE SPLIT END OR "FLAG" IS AN IMPORTANT CHARACTERISTIC OF BRISTLE



a favorite food of the Oriental. Bristle, which plays such an important part in the manufacture of brushes, is simply an incidental by-product in the slaughter of these swine for food.

Fortunately, for our needs, the Chinese prefer their pork considerably older than we do, which allows the bristle to grow to a greater length than any ever grown in this country. Age alone, however, does not produce the longer and stiffer bristle; it is a combination of age, the extremes of climate and the semi-wild strain of Chinese boars, for there the pigs are not kept penned and fed as domestic animals; they run untended and forage for themselves.

As a result of the great range of climate in China, different sections produce bristle of widely different characteristics. These MANCHUKUO various kinds of bristle are generally known by the

principal dressing points such as Tientsin, Mukden, Hankow, and Chungking, where

American, English and other European agents go to buy in quantity for distribution to brush manufacturers throughout the world.

Everything that goes into a brush in the way of brushmakers' skill and refinement of design is of secondary importance to the first step-laying out the bristle batch.

Two brushes of different makes may look alike in every detail; one will work with entire satisfaction, the other fail completely-why? Because of the character of the bristle, the constituents of the batch, and the method of dressing the stock.



Bristle batch formulas vary as much as paint formulas; the kinds (and lengths) of bristle that go to make up the batches are as different in character as the basic pigments of paints. Various kinds of bristle will differ in taper, elasticity, size of the flag, ability to resist abrasion and so on, though all have their special uses in brushmaking.

The flags of several typical kinds of bristle are clearly shown in the photographic enlargements at the right. To one familiar with bristle, the flags as shown readily identify the different groups.

Tientsin bristle, the most generally used class, is smaller in diameter than other types and has a finer flag. It is used in flat varnish brushes, and in paint brushes, frequently reinforced with stiffer bristle such as *Hankow*.

The latter has less taper, though greater stiffness as well as a larger flag than Tientsin. Hankow is seldom used in brushes intended for painting without mixing with Tientsin.

Chungking is a stiff Chinese bristle with comparatively little taper and a heavy flag. It is seldom used in paint brushes and never without mixing with other softer grades. It is mostly used in brushes which are cut back for stiffness, such as furniture rubbing, scrubs, etc., also in paper-hangers' smoothers.

Each brush and each size, in fact, is a special problem in itself. The bristle batch is studied from the standpoint of what the brush is expected to do. Certain well-known types take six or seven different kinds and lengths of bristle carefully proportioned to give just the right degree of elasticity, the proper capacity, top and general working qualities. The brush must be designed so that as it wears down new flags (shorter lengths of bristle) are presented

TIENTSIN

to retain its capacity and keep the brush at its ideal working stride.

The difference in the character of Russian bristle, as a class, compared with most Chinese bristle is quite marked. It is heavier and coarser in texture, has comparatively little taper, and a very much heavier flag. To some extent Russian bristle resists abrasion better than Chinese bristle. It is slower to soften in water and for that reason is used quite generally in calcimine brushes. On account of its coarseness and large flag, the stiff Russian bristle would not be suited to varnish brushes, for example. Other grades of Russian bristle, dressed in France, Germany and Poland, are used for this purpose, but these are special grades and known generally by the name of the country in which they are dressed rather than as Russian bristle.

The description of these types of bristle is of necessity quite general. There are many different grades and brands within these groups, each with its special characteristics. A lifetime spent in their study would scarcely serve to acquaint you with them thoroughly. The important thing is this: into your brushes go the accumulated knowledge and skill of eighty-eight or more years of continuous brushmaking, fortified by our contact with other Divisions of our Company who can and do aid materially in the development of brushes that are thoroughly practical, and for that reason, the most economical for the consumer. And, being salable, are the most profitable for the distributor.

Judged by our standards, the collection of raw stock, as the bristle is called before it is dressed or straightened, is a slow, laborious and prim-



YELLOW RUSSIAN BRISTLE—ORIGINAL BUNDLE

itive process. It is only the disregard of the Chinese for time and the incredibly low wage scale that make possible the prices at which bristle can be bought.

A number of years ago the Chinese Government estimated there were about 800,000 fully grown pigs in the province of Shantung alone, probably 600,000 or more being slaughtered annually.

On the average, each pig yields about one "catty", a little over a pound and a quarter, of bristle. Only certain portions can be used in the manufacture of brushes: the long, stiff hairs along the backbone are the most desirable, while the shorter and softer bristles that grow on the legs, flanks and belly are a drug on the market and are used for making rope and fertilizer by the natives.

Bristle is removed from the swine, after they are slaughtered, by plunging the body into scalding water which softens the flesh for a brief period so that the bristle can then be scraped off by means of an iron blade.

Hogs are killed throughout the year, but between October and March, when fish are scarce and preparations are under way for the Chinese New Year festivals, large numbers of swine are slaughtered, and bristle is available in greater quantity; in fact, the price of bristle is generally established during February and March for an indefinite period.

Chinese buyers of raw stock send their agents to the various localities to buy their bristle as it is taken from the swine. On account of the relatively low value of the bristle and the currency in use, these buyers take a supply of silver dollars with them and exchange them for copper coins in the various communities as they buy. Not infrequently these agents are beaten and robbed by the bandits who roam the countryside in small bands.

The bristle thus collected in the rural districts is carried in sacks, averaging perhaps eighty pounds of bristle, and is forwarded by various primitive means of transportation—wheelbarrow, horseback and small river junks—to the "godowns" or dressing stations where it is prepared for export.

In the dressing stations (known as tso fang tien) the bristle is



CHINESE DRESSING STATION

first classified roughly for texture, length, stiffness and the amount of foreign matter it contains.

As the godowns are supplied generally by certain districts, determined by the navigable waterways which serve them, the general character of the bristle they receive is fairly uniform and constant.

Without the extraordinary patience of the Chinese, bristle for the manufacture of brushes would be all but impossible to obtain on a commercial scale. It reaches the godowns in a dirty condition, mixed and matted almost beyond recognition. There it is washed and set out in the sun to dry in bamboo trays. Next it is combed, by means of wooden combs, to remove short hairs, as well as any foreign matter not taken care of in the washing, and then arranged in an orderly fashion with the flag ends one way and the butts the other.

Bristle is classified according to its length; it is gathered into

small bundles averaging about 1½" in diameter, which are neatly tied with cord. These bundles are wrapped in paper, one or two such bundles to a package, then stamped with the contents, length, and "chop", or, as we would designate it, the brand of the dresser. The finished paper-covered bundles of bristle are packed in wooden cases, roughly 2 x 1 x 1½ feet, containing on the average 82½ catties or about 110 pounds apiece.

The outstanding characteristics of the Chinese packaging of raw bristle are the remarkable thoroughness and neatness evident in the finished work. In general, women and children are employed for the sorting of bristle. A skilled worker can sort possibly 2½ pounds of bristle per day, for which she receives perhaps less than ten cents!

Bristle is generally sold in Assortments known as "55's" and "66's", indicating the number of such cases contained in the Assortment. These Assortments contain fixed amounts of the various lengths of bristle, from $2\frac{1}{2}$ " long up to $5\frac{1}{2}$ " and 6". For example, a 55 Assortment customarily contains two cases of $2\frac{1}{2}$ " bristle, three cases of $2\frac{3}{4}$ ", five cases of 3", five cases of $3\frac{1}{4}$ " and so on.



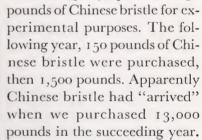
CHINESE BLEACHING AND DRYING RACKS

Bristle for the average run of brushmaking is seldom purchased in lots of one length only. Assortments, since they represent a considerable investment, can only be purchased by substantial manufacturers. The bristle can, of course, be bought in separate sizes, but only at a premium.

There is an interesting sidelight on the introduction of Chinese bristle into western commerce, which, while not important to brush manufacture perhaps, serves as a reminder that one product well handled is almost always the means of successfully introducing others.

For many years prior to the introduction of Chinese bristle, hat manufacturers imported straw braid from China. The native merchants eventually discovered that bristle was used in large quantities in brushmaking and sent samples abroad to determine whether their product was suitable for this purpose.

The exact date of the first experimental shipment is not known, but Baltimore, being a large straw hat manufacturing center importing straw braid in quantity, was doubtless one of the first to become acquainted with the new Chinese bristle. In 1889, Rennous, Kleinle & Company (which is now the Brush Division of the Pittsburgh Plate Glass Company) purchased 50



One of the great handicaps in the introduction of this new bristle was the prejudice of painters who knew nothing but the white, yellow and gray which came from Russia, Poland, Germany and France,



AND UNWRAPPED

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UNLOADING A "55" ASSORTMENT OF BRISTLE

whence came practically all of the bristle used in brushes at that time.

China bristle was regarded with suspicion as cheap Russian stock dyed black to hide its imperfections. A little thought should have shown it was impossible to sell brushes made of the new bristle at so much lower prices had they been made of dyed Russian, since the China cost somewhat less than half the price of any other bristle in use at that time. But there was a lingering prejudice that could only be overcome by time and a demonstrated economy of the new Chinese bristle brushes.

In the case of Chinese bristle it is the black that is in demand for paint brush manufacture; white Chinese bristle, however, is produced in commercial quantities. White Hankow and Chungking are well-known grades of white Chinese bristle, but their principal use is in the manufacture of tooth brushes and hand scrubs. We have treated of the collection and preparation of Chinese bristle at some length, since Chinese bristle is the most important single item in brush manufacture. There are, however, a number of other kinds of bristle which are important brush-making materials. Foremost among these is what is classified broadly as Russian bristle, but Russia, extending from the Arctic Ocean to the Black Sea, embraces an even greater range of climate than China, resulting in many kinds of bristle of widely different characteristics. Some of these are suited to brush manufacture; many others are not.

At one time Russian bristle dominated the brushmaking world, but the introduction of Chinese bristle at much lower prices, the many advancements in paint products and methods of application, the changed economic conditions in Russia—all have played some part in the eclipse of Russia as a source of bristle supply.

In Russia, yellow, white and gray bristle predominate. True black Russian bristles are rarely seen, and while they can be secured at times, the supply is not dependable. There is apparently less black Russian bristle produced in a commercial way than



there is white Chinese. The socalled gray Russian bristle is not composed of individual gray hairs; it is in reality a mixture of black, brown, white and yellow as it grows on the swine. The resultant color will vary with the amount of light and dark bristle a given lot contains.

There were formerly two principal styles of dressing Russian bristle known as "Lecks" and "Okatkas". The raw bristle in each case was of the same basic quality, and it was possible to make Lecks from Okatkas

or vice versa. The Lecks were "dragged" or sorted more closely so that each bundle contained bristle of practically uniform length. Such stock is known as "solid". The Okatkas contained different lengths of bristle in the same bundle, giving us what is known as "tapered" stock. (The word taper in this case does not refer to the natural taper of the individual bristles, but indicates a percentage of shorter bristle mixed with the long.)

In comparison with modern packing methods, Russian bristle seemed crudely packed, but there were many brands offering



a uniform quality and appearance unknown to the bristle trade today. Such brands as "Ch Ch" and "JK" among the Russian Lecks, as well as "Jillens" and "Ersoski" among the Siberian dressed Okatkas, represented an unvarying standard that could be safely bought by name. Today, these once famous dressers are dead. Their brands have disappeared and with them the quality for which they were noted.

In place of the crude-looking bundles four to six inches in diameter, often tied with bark and sealed by the Imperial Government with red wax before they were packed in casks, we now have small, neat bundles—but not the old quality.

A number of different factors have contributed to the decline of Russian bristle quality. It is believed by some that gradual change in the breed of swine has resulted in softer bristle generally; others claim the swine are killed earlier, which will not allow the bristle to grow to its full strength. Whether these conjectures are true or not, we are not prepared to say. It is generally agreed, however, that the nationalization of the bristle industry by the Soviet Government has deprived us of many of the benefits of the old system. Competition kept the independent bristle dressers on the alert for the quality of the raw stock they purchased. Their brands were their bond and the quality was thus constantly maintained.

Under the Soviet regime certain types of bristle were first dressed only at given points, but in the interests of production all bristle was later taken to one great central point and distributed to the dressing factories as they required work. This system quickly resulted in a uniformly poor quality.

Finding that stiff bristle was in demand, the Soviets endeavored to make the decreasing supply go as far as possible by adding more and more soft, or half-stiff, bristle, still further lowering the

average quality.

In the old days dealers examined and passed upon every individual lot of bristle before they purchased it. Bristle markets were an important feature of the great fairs at Leipzig and St. Petersburg (now Leningrad) and there dealers' representatives gathered to study the bristle market and make their purchases. At the present time, however, the Soviet Government contracts with dealers before the bristle is dressed, and regardless of the quality of the finished product, it must be taken up on the basis of these contracts.

The old Russian and Siberian methods of dressing bristle are rapidly disappearing. The present tendency is to dress Russian bristle in the same fashion as the Chinese, that is, tied in small bundles an inch and a half or so in diameter, and these, in turn, are packed one or two in a paper package. They are shipped in cases rather than casks as in the past.

Russian bristle is no longer used in the general run of paint brushes. Its principal uses are in calcimine brushes, skimming, paste, sweeps, dusters, etc., and special machine brushes. It is used chiefly where bristle is required to resist abrasion or the softening effect of water. In addition to the Chinese and Russian bristles described there are several other kinds of bristles which, though relatively unimportant from the standpoint of quantity consumption, are well-known to the brush manufacturing industry.

Some of these are simply variants of types already mentioned, as for example Bucharest, which is made up of the shorter lengths, or "bottoms", of Russian Lecks. Likewise Spitz, which comes in three different grades known as Spitz, Spitz-Spitz and Extra Spitz, according to length, is made of sortings of the softer Russian grades. Softness is necessarily a relative term. The Spitz, for instance, while soft compared with Russian bristle, which renders it unfit for calcimine brushes, is better than the Schlagers and Pinsels, which will be mentioned later, and stiffer than the popular Chinese Tientsin.

Turkey and Bessarabia furnish a certain amount of bristle, which is generally gray or dark yellow. It is all rather harsh, coarse in texture, and has a long, imperfect flag. Such bristle is not used in our regular lines.

Schlager and Pinsel are of German or Polish origin dressed in Germany. While of the same basic quality, the former are gray, the latter yellow. In comparison with Russian Lecks or Okatkas, the Schlager and Pinsel seem thin and soft. They are more like the Tientsin of China in texture. Formerly they were used in fairly large quantities, but the gradual change to Chinese bristle has left Schlager and Pinsel relatively unimportant grades in modern brush manufacture in this country.

Most of the German bristles are merely dressed in Germany; a few possibly originate in the colder sections in the northeast near Poland, but the bulk of German bristle comes from Russia or Poland. Of the bristle we know as German, white predominates; it is generally available in lengths from 2½" to 5½" and is somewhat stiffer than comparable French bristle. Curiously, the so-called French bristle is eighty per cent. German, and possibly twenty per cent. native. The French are excellent dressers and bleachers of bristle and much of their bristle is used in artist brushes, cutters, fine varnish flowing brushes, etc.

A small amount of bristle comes from the central, hilly sections of Bulgaria and Rumania. It is fair in quality but has many peculiarities that render it less attractive than other kinds of bristle, which are more plentiful and generally available.

India, likewise, furnishes a small amount of bristle known as Calcutta. It is harsh in texture, as a result of the climate and the breed of boars. Certain kinds of Indian swine run wild and are hunted as wild game. Calcutta bristle is quite stiff, tapering off sharply from a heavy butt to a long, ragged flag. The bulk of Indian bristle is dark with a characteristic reddish-brown flag, though the lighter colors can be purchased at times.



INSERTING BRISTLE IN CONE PREPARATORY TO STRAIGHTENING

All of the different bristles enumerated are of minor importance in modern brush manufacture. China is our chief source of bristle supply today; Russia occupies a second place, far behind China.

As one of the means of maintaining quality, the bristle, as it reaches us, is first checked for length. The original cases are opened, the paper packing removed, and each bundle gauged for length. A careful check discloses many bundles which do not quite measure to the full quarter-inch sizes, these are then reclassified as the intermediate eighth-inch sizes.

As it grows on the swine, bristle has a natural bend or twist

which must be permanently and completely removed before the bristle is suitable for brushmaking. In the straightening process a natural characteristic of the bristle, its ability to absorb water, is turned to advantage. The bristle is placed in open-end metal cones, tapered to correspond to the natural







THE STRAIGHTENING PROCESS IN DIAGRAM, THE CONE— OPENED TO SHOW UNSTRAIGHTENED BRISTLE—AND AFTER STRAIGHTENING

taper of the bristle. The cones filled with bristle are placed in lukewarm water, which is then brought to the boiling point and held there for approximately two hours. The bristle absorbs water in the process (as high as 60% of its own weight) and, as it swells, it exerts pressure against the cone, which, being straight, takes the bend out of the bristle. This pressure is uniform throughout the cone, so that the bristle at the center of the bundle is straightened as completely as that which comes in direct contact with the cone.

The bristle, still in cones, is then placed in huge vacuum driers at a moderate temperature. After seven or eight hours it is removed from the driers, and then taken out of the cones. The bristle is how clean, straight and dry.

What an advance this method represents over the earlier method of cleaning and straightening bristle! Before the straightening

MODERN VACUUM DRIERS





THE OLD-FASHIONED METHOD OF STRAIGHTENING

cones were first employed, it was customary to wrap the unstraightened bristle with cord. Aside from the slowness of this process and the amount of labor entailed (we have had as many as thirteen on the payroll at one time who did nothing but wrap bristle), it was never entirely satisfactory because of the irregularity of the straightening. The accompanying illustration shows the old-fashioned cord wrapping. Any defect in the wrapping resulting from hurried work or handling left unstraightened bristle that was quite sure to show up in the completed brush. The drying, which was accomplished slowly by heat, not only took six or seven days to cure the bristle, but did not insure the same uniformity in absence of moisture. In the manufacture of quality brushes each

step has a direct bearing on the succeeding steps and the working ability of the completed brush. This is particularly well illustrated in the cleaning and straightening of bristle.

Bristle as it comes from the vacuum drier, while sterilized, straight and dry, is still not ready for the brushmaker. One of the most important steps, calling for a wealth of experience and a highly specialized knowledge on the part of worker and supervisor, is to follow.

The preparation and mixing of the bristle "batches", as they are called, is one of the key operations in brush manufacture. Into the planning and execution of the bristle batches goes the accumulated experience of the better part of a century of brushmaking, fortified by a first-hand knowledge of painters' needs and brush requirements. Each kind of bristle has its characteristic working qualities, and different lengths of the same bristle have different working qualities. Furthermore, there must be flags

throughout the working length of the brush, necessitating several lengths of bristle, to carry the paint properly. How best to combine various lengths and kinds of bristle to secure definite predetermined working qualities in the completed brush is the real test of the skill and knowledge of the bristle man.

Once the constituents and proportions of a bristle batch have been determined, the batch is prepared in the following way: Each kind and length of bristle entering into the batch is carefully weighed according to the formula, and laid out in layers on a bench as shown in the accompanying illustration. These are then placed in machines and thoroughly mixed so as to give an absolutely uniform mixture. The mixing is automatic, but the supervision and constant inspection are just as close as if it were done by hand.

LAYING OUT THE BRISTLE BATCH WITH SCIENTIFIC ACCURACY AND CAR

The old hand method of mixing is shown on this page. The bristle dresser takes a section of the bristle as laid out in layers (including all layers, so that he has in his hands a bundle of unmixed bristle containing all lengths and kinds in their correct proportions) and runs it through the comb shown, in order to keep it straight. Next he carefully divides the bundle from top to bottom, and places one-half on top of the other, being careful to keep the layers of bristle, as first laid out, still horizontal. Where the worker first had, say, six layers of bristle, he now has twelve. Again it is combed to keep it straight. Again it is divided, so that he now has twenty-four layers. The combing and dividing are repeated until finally there are so many layers that they com-

pletely lose their identity and the bristle is thoroughly intermixed.

The principle of hand mixing, as previously described, is carried out in modern practice with greater speed and efficiency by machinery designed for this specific purpose.

The bristle, after it has been laid out in consecutive layers in accordance with the weights of the formula specifications, is next placed on an endless belt-conveyor in the mixing-and-combing machine. The capacity of the machine is determined by the length of the carrier. The machine is filled or "loaded" when the belt is uniformly covered by a layer of bristle one-half to three-quarters



COMBING BRISTLE BY HAND



ONE OF THE BATTERY OF MIXING-AND-COMBING MACHINES WHICH THOROUGHLY MIX THE BRISTLE ACCORDING TO STANDARD FORMULAS

of an inch in depth. Great skill is required.

As the bristle is carried along on the endless belt, an oscillating arm, moving at two or three times the speed of the belt, constantly doubles the layer of bristle back upon itself. This is the mechanical counterpart of the hand operation of dividing the bundle vertically and placing one-half upon the other, thus doubling the number of layers after each such operation. On the mixing machine this takes place as a continuous movement and at such a speed that it cannot be observed readily, but its frequency and continuity insure a more thorough intermixing of the batch constituents than is practicable with the hand operation.

As the bristle moves along on its carrier, it is combed by revolving combs, one of which combs the flag end of the bristle, the other the butt end. These combs, with their continuous movement, complete the mixing begun by the oscillating arm, and, incidentally, keep the bristle straight and at right angles to the

motion of the endless belt carrying the bristle.

Meantime, as the bristle continues its movement on the endless belt, a rapidly-revolving wheel about four inches wide, whose face is closely covered with sharp metal pins, removes any animal matter from the butt of the bristle which may have been left after the straightening and sterilizing process. The foreign matter thus removed is drawn away through an exhaust hood.

The number of circuits the bristle makes in the mixing-and-combing machine is determined by experience. After it has made the prescribed number of circuits, the bristle is unloaded by hand while the conveyor continues moving. After it is taken from the mixing machine, bristle is packed in convenient, paper-covered bundles secured by a metal band in order to keep it clean and straight until it is placed in the hands of the brushmaker.

As an assurance of uniform quality and to reduce the cost of manufacture by every reasonable means, the bristle entering into standard items, such as the Best Black, the Arkay, the Fulton, and many others, is dressed in lots of a thousand pounds or more at a time. This method of production means an unvarying standard of high quality that cannot be approximated by less accurate and scientific control of basic materials.

One of the questions that every visitor to the brush factory asks is: "What do you do with all the bristle that falls to the floor . . . do you use it again?"

The answer is, "Yes, we do. Such bristle, known as *rifling*, is carefully collected, cleaned and sorted, and ultimately goes into certain limited classes of brushes requiring a medium grade of bristle."

While rifling represents an insignificant percentage of the bristle we use, in the course of large scale operations it amounts to a good many thousand dollars. It is important enough to keep a crew of men constantly engaged exclusively on this work; we dress all of our own rifling and are consequently able to control its quality. We do not employ rifling as a means of cheapening brushes, but simply as an efficient utilization of all of the bristle that can be handled satisfactorily.

Rifling, as we dress it, coming from standard stock is of the same general character as the regular bristle batches. Except for the fact that a small percentage of it may become bruised in the collection, cleaning and sorting, our rifling is of the same grade as regular lines.

There is one important point to emphasize in regard to the bristle used in Gold Stripe Brushes: the formulation of the bristle batches.

The term "pure bristle" is rather misleading, as it signifies nothing of itself. A brush may be made entirely of bristle and yet be quite unsuited to painting of any kind. The important thing is the *character* of the bristle; a well-designed brush may have as many as five or six different kinds and lengths of bristle, thoroughly intermixed to give the proper *top*, *elasticity* and *taper*; in short, the working qualities of the brush. It is in the mixing of the bristle batch, that the accumulated experience of many years and close knowledge of the characteristics of bristle are called into critical use.

In Gold Stripe Brushes, the formulas are determined with scientific accuracy in order to insure the proper working qualities in the completed brush. Over eighty-eight years of actual brushmaking experience has gone into the formulation of the bristle batches, and during that time over two thousand different bristle formulas have been created to satisfy the needs of brushes for different purposes.



Coarse Brushmaking Materials

HORSEHAIR

In addition to bristle and soft hair there are a number of other materials employed in the manufacture of brushes not classified as paint brushes. Of these the most important is horsehair, which is obtained from all parts of the world with the exception of Africa.

The hair from each section has some peculiar characteristic; within the section, there are also variations resulting from different methods of selection and dressing. Value is determined by stiffness and color.

The following list of well-known types of horsehair indicates their relative quality:

Australian Horsehair South American Horsehair Domestic Horsehair Manchurian China Horsehair Newchwang China Horsehair Italian Horsehair English Horsehair Mongolian China Horsehair Tientsin China Horsehair

This is not a fixed relationship, for supply and demand will cause considerable difference in values.

The bulk of the horsehair used today comes from China and South America. It is collected through agents of native brokers, brought to the warehouses of the exporters, and there sorted, selected and repacked under the shipper's brand. Shippers endeavor to maintain uniform standards of quality and dressing, but often variations in quality are evident.

In Manchuria the coarsest and stiffest China hair is obtained. The Newchwang is practically as stiff as Manchurian, but of finer texture and has more life; Mongolian hair, softer than either of the two mentioned, is of fine texture and fairly glossy. Tientsin hair is the softest of the four. "Italian" and "English" hair are generally South American or Russian horsehair dressed in Italy or England, not hair produced in these countries.

It is the practice of some dressers to mix tail and mane hair while others, to obtain stiffer hair, dress only tail hair under certain brands. Standard assortments contain the four colors, white, light gray, dark gray or mixed, and black; and sizes run from three or four inches up to thirty or thirty-six inches in length.

As the quality of horsehair varies from time to time, it is impossible for a manufacturer who wishes to produce brushes of a uniform quality to standardize on any particular grade or brand. Uniform brush quality can only be maintained by careful preparation and mixing, so that variations in the raw stock are cor-

rected by the mixing formulas. Horsehair is never used in good paint brushes. For certain types of work such as rough painting on structural steel, where brush marks are not objectionable, horsehair mixed with bristle is an aid in resisting abrasion. However, brushes made in this way do not have the capacity or the stiffness of pure bristle brushes.

The principal use of horsehair is in combination with bristle in the manufacture of sweeps, painter dusters, counter and mill dusters, and in many miscellaneous brushes such as sanitary, spoke cleaner, bottle and special machine brushes.

FIBRE

The vegetable fibres most widely used are the *Istle* or *Tam-pico fibres*. The name Tampico, which is commonly used in referring to all grades of Istle, has no particular significance, being merely the name of the port in Mexico from which the fibre is generally shipped.

There are four grades of Istle, namely Tula, Pita, Palma and Jaumave, which are all obtained from plants of the Cactus family.

Tula and Jaumave are the products of bush cactus plants of northern Mexico. Tula is the heaviest grade, a very tough, resilient, greenish-white fibre ranging in length from ten to twenty-four inches. It is the least uniform in length and texture. Jaumave is a much longer, finer, better color and uniform fibre than Tula, running from sixteen to thirty inches in length.

Palma and Pita are obtained from plants classed as tree cactus. These two grades are softer and more pithy fibres than Tula and Jaumave, and have not as much life. They are of a brownish color and run from twenty to thirty inches in length. Pita is the coarser of the two but not as coarse as Jaumave. Palma is the finest of the four grades of Istle, being a very soft fibre, with the least life. It runs in length from eighteen to twenty-six inches, and is the poorest color, being a dark brown.

The unlimited possibilities of these fibres can be best illustrated by the fact that there are grades for abrasive brushes and for shaving brushes, with all qualities in between. They are readily

dyed and can be obtained in any color.

Four or five thousand grades of Istle have in no way exhausted the possible number of combinations and degrees of fineness or color that can be made with this fibre.

Patent fibre or polished fibre is made from selected grades of Jaumave especially cleaned and polished. This is sometimes used as a substitute for horsehair.

As indicated by the many grades available, the use of this fibre is almost unlimited and practically any type of brush can be made with it. Its greatest use is in the manufacture of sweeps, scrubs, dusters and numerous specialized types.

Palmetto is the only brush fibre that is produced commercially in the United States. It is obtained from the palmetto tree, a native of the Florida swamps, the Bahamas and Cuba. After processing and curing, the fibre obtained is extremely elastic and durable and has a rich ox red color. It runs from eighteen to twenty-four inches in length. It is probably the most difficult to produce and therefore one of the most expensive.

Palmetto is suitable for use in brushes that get hard wear and especially if they come in contact with water, such as deck scrubs.

Bassine and Palmyra are the products of the same palm, *Borassus flabelliformis*, which is a native of Ceylon and the eastern coast of India. Palmyra is the softer, finer, cinnamon brown fibre obtained from the inside of the stalks. It varies slightly in color and stiffness. Lengths run from nine to eighteen inches. Bassine is selected stiff Palmyra that has been dyed a dark coffee color and cut to even lengths, from four to sixteen inches.

Bassine and Palmyra are used in scrubbing, flue, sink, horse, garage, brewery, dairy, sanitary foundry brushes, as well as sweeps and brooms. They are about the heaviest fibres that can be satisfactorily handled in all methods of manufacture, such as twisted-in-wire, pegged, stapled, pitch-set and drawn.

African Bass is obtained from the feather-leaf palm, *Raphia vinifera*, which grows in the river valleys of the Atlantic coast of Central Africa. There are different grades known by the name of the ports from which they are shipped. The Calabar or Flexible

Bass, as it is sometimes called, is the most desirable grade, being heavier and coarser in texture. It is hard-surfaced, slightly oval and with a uniform rich dark brown color. Lengths are from four to five feet. Sherbo Bass is probably the most important grade of African Bass, being obtainable in large quantities. This bass is lighter and less uniform in color than Calabar, has a rougher, rounder fibre, is lighter in weight and not so flexible, but not brittle. It is a tough fibre with good life and is fairly uniform in size of strands.

African Bass is readily dyed and is preferred that way for some classes of work; its principal use is in the manufacture of street or barn brooms.

Bahia is produced in South America, growing along the rivers in the swampy lowlands of northern Brazil. The fibre is a light brownish red in color. Lengths are from four to fifteen feet; it is tapered, sometimes from as much as three-sixteenths of an inch at the heavy butt to a hair-like tip. It is adaptable for use in all types of brooms from the household style to the rotary street sweepers. It is the heaviest in proportion to its bulk of any fibre, has a great deal of life and wonderful wearing qualities. It is inclined to be slightly brittle, especially in the coarser grades; consequently, it is frequently blended with the more flexible African Bass.

Rice Root is the stiff, yellow, crinkly root of a large bunchgrass that grows on the mountain sides in central Mexico and Guatemala. This fibre is generally used by the brush maker without preparation except cutting to length. It is used principally in horse, creamery, brewery, and scrubbing brushes.



THE "CAMEL" THAT SUPPLIES "CAMEL HAIR" IS THE SIBERIAN SQUIRREL

Soft Hair Brushmaking Materials

Bristle, because of the quantity used, has elevated the boar to a stellar role in the brushmaking industry, but other animals also play an important part.

The brushes used by painter, decorator and artist are broadly classified as bristle brushes and soft hair brushes. If it were not for the ox hair used, the term "fur brushes" would be more descriptive than "soft hair", for we depend upon fur-bearing animals, particularly the various members of the weasel family, for the material used. Goat hair is used in some of the cheaper brushes.

A substantial amount of this material is obtained in our own country, but much of it is found only in the innermost sections of Siberia.

The most valuable of all furs used by the brushmaker is perhaps red sable or Siberian mink. This hair is very fine, has strong



sharp points, great elasticity, and carries color well. The red sable, or Kolinsky as it is called by the furrier, is about fifteen inches long, has an eight-inch tail, and is of a rich or brownish vellow; it is not red as the name might indicate. It is found in Siberia, east of the

Yenesei River. Comparatively few of these animals are caught and the fur is very expensive. It is the best hair for lettering and show card brushes and can be used in Japan colors, oil colors, and all of the heavier bodied sign writer materials.

The fur called "camel hair" is obtained from the tails of Siberian and Russian squirrels. These bear better pelts than American squirrels, whose hair is not suitable for brushes.

The Siberian and Russian squirrel hair are classified as Kazan, Sakkamina, and Talahutky. The province of Kazan furnishes red and reddish-gray skins. The hair of Sakkamina squirrels is usually referred to as "blue" by the trade; light blue skins come from Yeniseisk, and the deep steel blue color from Yakutsk. Talahutky squirrels, from southern Siberia, are scarce, the hair is a gray, with a pronounced darker stripe near the tip. It suggests badger hair in appearance, though it is much finer in texture.

Squirrel hair is straight and fine in body, but not very elastic. It is used in many types of brushes but is especially suitable for

brushes applying Japan colors, thin lacquers and light-bodied varnishes. Squirrel hair is used for water color, artist, lettering and striping brushes, but it is not as well suited to lettering and striping brushes as sable or ox hair.

Black Sable is another misnomer applied gener-



ally to the hair of the civet cat. This little striped or spotted animal, found in our central and western states, should not be confused with the skunk. The tail hair, which is black and very long, is straight and



regular, has good points, and is fairly elastic. It is used in lettering, striping, sign writer and lacquering brushes and is particularly adaptable for brushes used on muslin and similar fabrics.

Fitch is another name that sometimes causes confusion as it is used to describe a hair. The term is also used by the sign writer and painter in referring to a certain type of brush. When describing hair, it refers to the tail of the American skunk found in every part of the country, although the finest skins come from Michigan, Ohio, New York, Pennsylvania and the lower part of Canada. Fitch or skunk hair is seldom used alone as it is too coarse to replace either civet or black sable, but it makes a splendid sign writers' brush when combined with the proper amount of Chinese bristle.

The hair of the American black *bear* is sometimes used in brushes, but never alone; though of great strength, it is too kinky to be used in large proportions. It is used mixed with bristle, skunk or other hair.



AMERICAN BADGER

Badger hair, long looked upon as the best for flowing and finishing brushes, is very elastic and has greater tensile strength than any other soft hair. The badger is found throughout Europe, Asia, Canada, and the central and western portions of the United States. The best

hair comes from Russia, Siberia, Macedonia and the Balkans. The cost of imported hair, however, has encouraged the use of American hair, although the latter is too soft for the better grade brushes.

Ox hair, as the name implies, is obtained from cattle and is the soft hair taken from the ear of the animal. The best grades are from cattle raised in cold climates. The hair of European cattle is stronger and more elastic than that of our own cattle, although good brushes are made, using hair from domestic animals. Ox hair is used in making certain types of sign writer brushes, flowing brushes, also lettering, striping and marking brushes.

Goat hair is the least important of the group. It is largely obtained from pieces salvaged when making goatskin robes and coats. It lacks elasticity and its natural kink cannot be straightened. It is used either in its natural color or dyed black for the cheaper grades of mottling and bronzing brushes.

Japanese *pony hair* has little value though it does masquerade as "camel hair".

Genet, the dyed tail hair of the ringtail and other wild cats, is also used as a substitute for squirrel; it is soft, silky, and of attractive appearance.

The preparation of soft hair is tedious and costly and great skill is necessary in the processing from the skins to the dressed hair.



THE CHISEL IS BUILT INTO THE BRUSH—NOT CUT OR SANDED—BUT ACTUALLY BUILT IN AS AN INTEGRAL PART OF THE BRUSH.

Modern Brushmaking

Modern paint and varnish brushes owe their present state of perfection largely to American ingenuity, thoroughness and skill. France, perhaps, can still claim leadership in the manufacture of fine artist brushes, but American-made painters' tools, brushes of American design and type, are in every way superior to anything made in any other part of the world.

Brushes had been made in a commercial way across the seas long before the industry became established here. It was not until the early part of the century that paint brushes were made in this country, though paints had been made here for many years. The industry has been developed, especially in the last thirty-five years, until the fame of our brushes has traveled around the globe, and they are being used in every civilized country in the world.

Brushmaking is a complicated process, but devoid of any mystery and, though little understood by those who use brushes, is intensely interesting. It is a modern semi-mechanical method employing advanced ideas in tools and machinery, and calls for the highest skill on the part of many artisans.

The last step in the preparation of bristle for the brushmaker, as previously described in the chapter on bristle, is to take the thoroughly mixed batch from the mixing machines and pack it in bundles of convenient size. These bundles, which are of heavy kraft paper held in position with light metal bands, keep the bris-

WEIGHING BRISTLE-EACH BRUSH ACCURATE TO ONE SIXTY-FOURTH OF AN OUNCE



tle clean and straight until it reaches the brushmaker.

With each job that he executes, the brushmaker receives a specification slip giving him the details of the brushes he is to make, the quantity to be made, the bristle batch number, the weight of bristle in each individual brush, the length clear of the finished brush, and whether or not it is chiseled.

The weighing of bristle by the brushmaker himself is the first of many steps in the making of a brush. One of the characteristics that have distinguished Pittsburgh Plate Glass Company brushes for many years is their uniform quality, and careful weighing is one of the means of securing this uniformity.

Bristle is always weighed in a balance scale. With this type of scale, as shown in the illustration, there is no spring to lose its tension, thus leading to variation. Each brush is weighed with the pointer in exactly the center of the scale. The maximum variation is within ½ of an ounce—less than half the weight of an ordinary paper clip! As the bristle is weighed, it is laid out in carefully separated little piles convenient for the brushmaker.

As soon as he has weighed and laid out his bristle, the brushmaker arranges his other supplies—consisting principally of ferrules and, in the case of certain types, the wood or fiber strips for his greatest convenience and speed of production. These miscellaneous materials are brought to the brushmaker on regular scheduled deliveries from the General Stores Department to reduce lost time to a minimum.

The brushmaker consults his "check" to verify the specifications and is immediately in full swing "setting up", as the forming of the brush is known. This operation can be so briefly described that we may fail to give you a proper idea of the patience, skill and knowledge that go into this speedy operation. Skill in handling bristle can only be obtained through constant practice (it is not at all unusual to find records of 15, 20, 25 and more years of service among the master brushmakers); their setting up operation consequently seems much simpler and easier of execution than it is in reality.

In brief, then, this is what the standard types of flat paint brushes,



THE BRUSHMAKER AT WORK—NOTE THE REGULAR LITTLE PILES OF BRISTLE CONVENIENTLY LAID OUT

for example, go through. One of the accurately weighed bundles of bristle is picked up, making sure to include every single bristle that was weighed out. The bundle is then tapped lightly several times on the butt end—"butted down", as the operator speaks of it—and combed with a special steel brushmaker's comb to make sure that the bristles throughout the entire brush are parallel. Next, a piece of heavy manila paper, creased to fit inside the ferrule, is wrapped about the bristle and, acting as a shoe horn, is inserted with the bristle into the ferrule. The paper guide is then withdrawn and the bristle is left in place. Again the brush is combed, this time to make sure the bristles are perpendicular to the ferrule edge as well as parallel with one another; and again the brush is butted back; this time the butts of the bristle are brought flush with the top of the ferrule and present a solid, flat surface. If the brush specifications call for a strip (the reason for strips will be explained later), the ferrule is

then moved down a quarter or three-eighths of an inch on the bristle, leaving the butt ends exposed to that extent, and the brushmaker with a broad, thin blade opens up the butt ends of the bristle and inserts the size strip which the specifications designate.

This operation, apparently one of the simplest, actually calls for skill and practice, as the strip must be placed in the exact center of the brush and parallel with the sides of the ferrule. If the strip, particularly the thicker strips, is off center in any direction it will show up immediately the brush is put into work, for where a strip comes too close to the ferrule it tends to open up the brush at that point.

After the strip is inserted the bristle is butted back once more, making the butts of the bristle and the strip flush with the top of the ferrule. The brush is now ready for "gumming in".

Certain types of brushes, such as flat and oval varnish brushes, sash tools, cutters, artist brushes, etc., are chiselled, or made with the painting face of the brush rounded. Occasionally metal

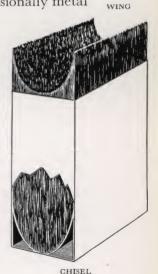
bound flat paint brushes are also chiselled, but generally speaking, brushes other than those indicated wear their own chisel in service.

The value of this chisel in the working qualities of a brush was recognized as far back as five hundred years ago, when one of the first commentators on the painting craft gave instructions for breaking brushes in on an abrasive surface, such as rough wall, in order to secure the desired chisel.

Today, however, the painter buys his brushes ready for use. Those that should be chiselled are made so by the manufacturer. While there are various ways of securing the chisel, there is only one entirely satisfactory way: the chisel must be built into the brush at the time it is set up, with-

out recourse to abrasives or cutting which destroy the valuable flag ends of the bristle.

The cut-away illustration shows the means by which the





WEIGHING BRISTLE

chisel is secured in the manufacture of the brush.

The brushmaker takes his carefully weighed bundle of bristle, butts it down, combs throughly and inserts it in the chiselling cup, flag ends down. The cup is then tapped smartly several times to make sure that the bristle throughout the entire bundle conforms with the shape of the chiseling cup. This is known as "flagging down". The sloped sides of the bottom of the cup, incidentally, are slightly roughened, so that the bristle will not slip down toward the center of the cup as it is tapped in the flagging-down movement.

The butt ends of the bristle, naturally, take a shape just the reverse of the chisel at the flag. In other words, the butt end is

concave instead of convex. The projecting sides, indicated in the diagram as "wings", are then cut off with shears, so that the butt end is again flat, as the wings would prevent the rubber penetrating to the proper depth in the setting and also interfere with the handle when it is inserted in the ferrule after the setting has been yulcanized.

When the wings have been trimmed the bristle is inserted in the ferrule, using a folded paper as a guide and to keep the bristle all in its proper place.

One of the operations that always arouses the interest of visitors to the brush factory is what is known as the "casing operation".

Certain brushes among the metal bound flat paints, stuccos, whitewash and flat calcimines are cased, that is, they are made with a layer or casing around the outside which differs from the "middle" or bristle in the center of the brush.

The casing is used on paint brushes for an entirely different reason from that of the casing on calcimine brushes. For example, the Superfine and Master Painter calcimine brushes are cased simply because calciminers prefer brushes of the lighter colors—white or yellow bristle. Yet because of their scarcity, as compared with the gray, to make calcimine brushes entirely of white or yellow stock would soon mean prohibitive prices. As the gray bristle is identical in quality and working characteristics with lighter-colored stock, the natural solution is to make a brush of gray middle and yellow casing. This meets the restrictions of bristle supply and at the same time satisfies the calciminer's demand for the light-colored brush.

In this connection it is important to emphasize again that the middle and casing, while differing in color, are identical in every other respect. The brush would have exactly the same working qualities, were it entirely yellow or entirely gray. Here the casing is used solely as a means of reconciling the demands of the painter with the available bristle supply.

Brushes such as the Best Black, however, are cased for an entirely different reason. As explained in the chapter devoted to



the bristle batch, various kinds and lengths of bristles are combined to give a brush its proper taper, elasticity, toppiness and capacity. The shorter lengths of bristle, which are thoroughly intermixed with the batch, show up on the surface of the brush and have a tendency to spatter, particularly with heavy-bodied or quick-drying paint products.

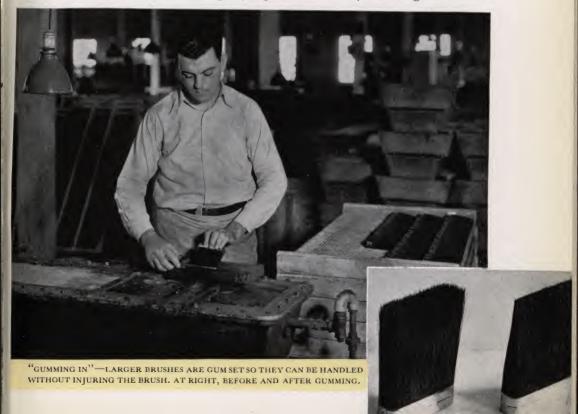
With brushes of this type the casing is the practical solution. The function of the casing, in this instance, is to prevent the short bristles of the middle mixture—with their tendency to spatter paint—from working to the surface. Consequently, the casing is of slightly stiffer stock than the middle, extends the full length clear of the brush and contains no short. It is however of the same color and general character—except the stiffness—as the middle.

In brushes such as the Best Black, the Extra Black Stucco and the Laurel Stucco, the casing is an important factor in their working quality.

A brush as first set up by the brushmaker is very fragile and easily ruined. It is not until the setting is completed that it can be handled without danger of disturbing the bristle, but as there are a number of operations necessary before the setting is finished, a temporary "gum set" is used.

As soon as the newly made brush leaves the brushmaker, it is "gummed in" by dipping it in a specially prepared light gum, as shown in the accompanying illustration which also shows a brush before and after it is gummed. Here it is the flag end of the brush that is dipped, not the butt end which will ultimately have a permanent vulcanized rubber setting.

Holding the brush firmly by the ferrule, the operator carefully dips the brush to a depth of several inches, depending upon the length of bristle, lightly squeezes out any excess gum and



carefully smooths the bristle, first one side and then the other. To make sure that the brush preserves the shape that the brushmaker built into it, the operation must be done with extreme care, as a brush put into "set" for any length of time tends to retain that shape. In this way the temporary gum setting of the flag end accentuates the desirable taper of brushes as made by the Pittsburgh Plate Glass Company.

As soon as the gum is dry, the brush can be handled without disturbing the bristle. When brushes are dipped in rubber, for example, the ferrule is slipped up the bristle while the butt end of the bristle stands in the rubber. If the bristle were not held in place securely at the flag end meantime, the brush would fall apart.

Before the brush is completed, the gum setting, of course, is thoroughly removed.

There are two entirely different ways of introducing rubber for the setting of a brush: dipping and pouring. Each has its special use, depending upon the size and style of the brush, kind of

bristle, etc. Dipping is used principally for larger, heavier brushes.

We have explained in detail how brushes, which up to this point cannot be



DIPPING IN RUBBER

At Left: Brush (showing ferrule raised) standing in perforated tray before rubber is admitted (note gauge for depth of rubber).

Above: Brush standing in rubber; every strand of bristle is completely surrounded by rubber.

handled satisfactorily otherwise, are dipped in a light gum which, when it has once set, enables the operator to handle such brushes safely and conveniently. The ferrule is next slipped back three-quarters of an inch from the ends of the bristle, and the brush is stood upon the exposed butt ends in perforated trays, as shown in the accompanying illustration.

Heavy bodied liquid rubber is forced through the openings in the trays until the rubber is at the level indicated by the ringgauge. As soon as the rubber reaches this level, it is held at this point until every individual bristle in each brush is thoroughly surrounded by the rubber to the desired depth. On the average, this requires about fifteen minutes, but the time must be gauged with care because of such variables as the weather, the evaporation of the rubber solvent, etc. If brushes stand too long, the rubber will rise too high as a result of capillary action and form what is known as a "bone",—rubber that extends beyond the edge of the ferrule when the ferrule is returned to its proper place. Only a skilled operator can tell the exact moment to take the brushes out of the rubber.

As soon as they are removed from the liquid rubber, the brushes are placed in kilns at a moderate temperature, where the heat quickly evaporates the rubber solvent, leaving it still plastic but relatively hard. This, however, is not to be confused with the vulcanizing which follows later. The succeeding operations are "shoving down"—pulling the brush part back through the ferrule so as to give the specified length clear—and then vulcanizing.

Most brushes are vulcanized nowadays—but there are many different vulcanizing methods.

Gold Stripe brushes are vulcanized under mechanical pressure. The brushes are placed on steam tables, on the open ferrule ends, bristle upward. The ferrules are clamped between parallel metal bars, with spacer blocks to control the pressure and keep the ferrules to specification thickness. This pressure makes the vulcanized rubber denser and harder—literally like granite. It also keeps the ferrules straight and parallel.



KEENE HANDLE PLANT

After vulcanizing, the brush is drilled through the ferrule and vulcanized setting, the rivets are inserted and spun. Because the rivets are inserted in holes drilled through the setting after vulcanizing, they do not have a tendency to make small bulges in the ferrule, or to split the rubber setting where paint might accumulate and cause the brush to "finger" when in use.

In its own modern plant at Keene, New Hampshire, the Pittsburgh Plate Glass Company manufactures its own brush handles.

Two reasons prompted this undertaking, first, economy; and second, but most important, control of design and quality.

Most brush manufacturers buy their handles from wood turners; as a result, there had been little improvement in design until the Pittsburgh Plate Glass Company, with its own handle plant, directed attention to the design and production of handles with many resultant refinements and improvements.

Beech and maple are the leading hardwoods used in brush handles. Only occasionally, as in the case of large flat calcimine brush handles which must be light in weight because of their size, is some special wood used, such as bass. The appearance, shape and finish of the handle are important in making the sale of a brush, but the less conscious the painter is of the handle after the brush goes into work, the better the handle is.

The carefully fitted handle, which has previously been stamped, is next inserted and "headed", or nailed, to the ferrule by semi-automatic machinery which drives several nails at a time.

The procedure described is followed for practically all flat types; leather bound, or "stucco" brushes as the painter knows them, are set up in a temporary metal band about an inch in width, and after they are dipped they are transferred to narrow metal bands in which they are permanently vulcanized. The temporary center plug is removed, the handle inserted, the leather "ferrule" or strap is placed in position and the brush nailed by hand.

After they have been handled, brushes are sent to the finishing department where they are beaten out to remove any loose bristle, trimmed, buffed, finally inspected, wrapped in the Gold Stripe fibre jacket and boxed.



THERE IS MORE TO HANDLE MANUFACTURE THAN APPEARS ON THE SURFACE. ABOVE—SOME OF THE 18 STEPS IN COMPLETING A HANDLE

The fibre jacket developed by the Brush Division of the Pittsburg Plate Glass Company has attracted wide attention because of its practical usefulness. This simple container makes it possible for the painter to keep his brush in perfect working condition by restoring it to its original shape when not in use. Easy directions on the jacket enable the amateur and professional painter alike to get the most out of their brushes.

Modern machinery is applied to the production of brushes wherever practicable, but the working qualities of brushes depend, in the final analysis, upon the character of the bristle batch and the skill of the brushmaker.



FOR THE GOLD STRIPE JACKET



Brush Merchandising

Intelligent merchants have learned through experience that the most successful way to sell paint products is to sell the entire job. In the case of the non-professional painter, this means finding out through careful questioning what he intends to paint, what effect he wishes to obtain—and then selling him the materials he needs with a clear explanation of their use.

The skilled painter knows definitely what materials and tools he needs, and demands them of his dealer—or changes to the dealer who is prepared to serve him in the way he expects.

Progressive paint dealers must know about the practical use of their products. It is for this reason that they select brushes which they feel confident will give their customers, professional and amateur alike, the expected results with their paint products.

In Gold Stripe brushes the dealer will find every type that is required for modern painting practices. With careful study of the community's needs he can select a short, compact line of brushes, which will enable him to render adequate service to his customers, and what is equally important, with a minimum investment on his part and the assurance of satisfactory profit and frequent stock turn-over.

From the viewpoint of salability, Gold Stripe brushes offer several unique advantages.

Their uniform finish distinguishes them readily; the skilled painter as he handles them can see their practical design and sense their working qualities which will be proved in use; the amateur will be guided first by the dealer's recommendation, but in the future will know the trademark and choose such a brush because it gives dependable painting satisfaction.

Of special importance is the Gold Stripe "jacket"—a patented feature which enables the user to get the greatest service from his brush, as this protective wrapper safeguards the brush when not in use. Easy directions, printed on each jacket, tell how to take care of the brush when not in paint. The jacket means that these brushes can be used again and again. All painters know that the well broken-in brush is the most satisfactory to work with, but the amateur, not knowing how to take care of his brush, frequently lets it get hard so that it can seldom be reclaimed for further practical use. The Gold Stripe jacket will enable him to take care of his brushes as skilled painters do; it will make a better brush user—and paint customer—out of him when it comes to those little touch-up jobs about the house where the services of the professional painter are not usually called in.

The riveted construction is the most important advancement in brushmaking since the development of the vulcanized rubber

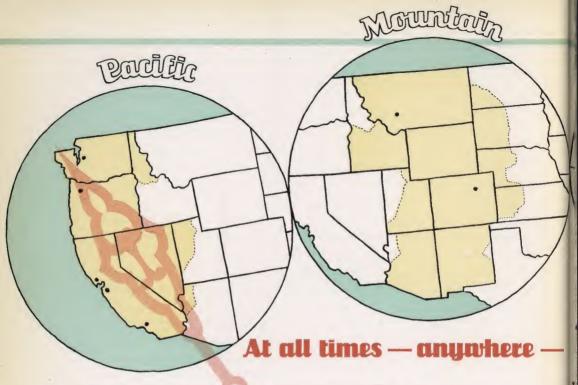
setting. It adds greatly to the strength of the brush—a recent test of a four inch Best Black wall brush enabled us to suspend 1014 pounds on a one-inch tuft of bristle without disturbing the setting—and makes a safer brush to use as well as an easier brush to clean. There are no jagged nail-ends to cut or scratch the fingers, no danger of resultant infection and loss of valuable time.

These are helpful sales points which the Gold Stripe dealer uses daily in increasing his sales: points which the painter, too, is quick to recognize, and which make him a loyal Gold Stripe brush user once he has tried them.

Detailed suggestions for the use and care of brushes are available to Gold Stripe distributors upon request to the nearest warehouse of the Pittsburgh Plate Glass Company.

The following general suggestions will be helpful to the dealer who is interested in keeping his stock fresh, presentable and most salable:

- 1. Keep the brushes in a cool, dry, dust-free place.
- 2. Naphthalene or moth-balls should be used freely to prevent moths—except for pitch-set brushes: naphthalene will destroy pitch.
- 3. Rotate stock carefully; do not permit brushes to become shopworn or unsalable by selling the newest brushes when the same type and size of previous shipments are still on hand.
- 4. Buy thoughtfully—keeping a careful watch on changing buying habits and painting practices—and make sure your stock is always up-to-the-minute.
- 5. Buy in standard package quantities in order to keep your stock uniform and business-like in appearance. A uniform stock of brushes, as well as paint products, gives confidence to your customer.



When service—prompt service!—counts, nothing will take its place. Such service is assured to users of Gold Stripe Brushes from coast to coast. There is a Pittsburgh Plate Glass Company Warehouse or Branch in important trading centers the country over, and brushes can be delivered in a few hours, or over-night at most.

Warehouses · Pacific Time

Los Angeles, Calif. Oakland, Calif. Portland, Oregon San Francisco, Calif. Seattle, Wash.

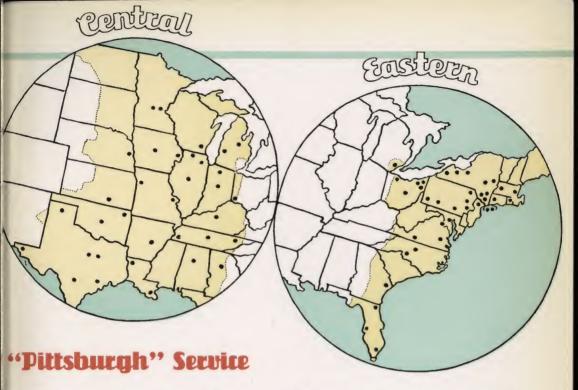
Branches · Pacific Time

Alhambra, Calif. Bakersfield, Calif. Bellingham, Wash. Centralia, Wash.
Everett, Wash.
Fresno, Calif.
Glendale, Calif.
Inglewood, Calif.
Long Beach, Calif.
Los Angeles, Calif. (6)
Medford, Oregon
Olympia, Wash.
Pasadena, Calif.
Riverside, Calif.
Sacramento, Calif.
Salem, Oregon

San Bernardino, Calif.
San Diego, Calif.
San Francisco, Calif. (2)
San Jose, Calif.
Santa Ana, Calif.
Santa Barbara, Calif.
Santa Rosa, Calif.
Seattle, Wash.
Spokane, Wash.
Stockton, Calif.
Tacoma, Wash.
Walla Walla, Wash.

Warehouses · Mountain Time

BUTTE, MONT. DENVER, COLO.



Varehouses · Central Time

AMARILLO, TEXAS ATLANTA, GA. BIRMINGHAM, ALA. CHICAGO, ILL. CINCINNATI, OHIO DALLAS, TEXAS DAVENPORT, IOWA DES MOINES, IOWA EL PASO, TEXAS FORT WORTH, TEXAS GRAND RAPIDS, MICH. HOUSTON, TEXAS INDIANAPOLIS, IND. KANSAS CITY, Mo. KNOXVILLE, TENN. LITTLE ROCK, ARK. LOUISVILLE, KY. MEMPHIS, TENN. MILWAUKEE, WIS. MINNEAPOLIS, MINN. NASHVILLE, TENN. NEW ORLEANS, LA. OKLAHOMA CITY, OKLA. OMAHA, NEBR. PEORIA, ILL. ROCKFORD, ILL.

Saginaw, Mich.
St. Louis, Mo.
St. Paul, Minn.
San Antonio, Texas
Shreveport, La.
South Bend, Ind.
Tulsa, Okla.

Branches . Central Time

Danville, Ill. Davenport, lowa Dubuque, Iowa Lincoln, Nebraska Little Rock, Ark. Madison, Wisconsin Mansfield, Ohio Mobile, Ala. Montgomery, Ala. Muskegon, Mich. Oshkosh, Wisc. Paducah, Ky. St. Joseph, Mo. Springfield, Ill. Springfield, Mo. Springfield, Ohio Terre Haute, Ind. Topeka, Kan.

Warehouses . Eastern Time

AKRON, OHIO ALBANY, N. Y. ALLENTOWN, PA. BALTIMORE, MD. BOSTON, MASS. BRONX, N. Y. BROOKLYN, N. Y. BUFFALO, N. Y. CHARLOTTE, N. C. CLEVELAND, OHIO COLUMBUS, OHIO DETROIT, MICH. HARRISBURG, PA. HARTFORD, CONN. HIGH POINT, N. C. JACKSONVILLE, FLA. MIAMI, FLA. MINEOLA, N. Y. Mt. Vernon, N. Y. NEWARK, N. J. NEW HAVEN, CONN. PHILADELPHIA, PA. PITTSBURGH, PA. PROVIDENCE, R. I.

RICHMOND, VA.
ROANOKE, VA.
ROANOKE, VA.
ROCHESTER, N. Y.
SAVANNAH, GA.
SCRANTON, PA.
SPRINGFIELD, MASS.
SYRACUSE, N. Y.
TAMPA, FLA.
TOLEDO, OHIO
UTICA, N. Y.
WASHINGTON, D. C.
WILKES-BARRE, PA.
YOUNGSTOWN, OHIO

Branches · Eastern Time

Augusta, Ga. Charleston, S. C. Columbia, S. C. Durham, N. C. Findlay, Ohio Fostoria, Ohio Greensboro, N. C. Greenville, S. C. Lynchburg, Va. Tiffin, Ohio Zancsville, Ohio

